

The market organization in the wine industry. Farms, merchants, & cooperatives

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Facts, I

- The industrial organization of the wine sector may be quite complex, but relatively similar across different countries.
- At the farm level, producers **grow grapes**.
- Then, grapes are **processed to make wine**.
 1. At the farm level, in vertically-integrated firms (VI).
In alternative,
 2. they can be delivered to a wine-cooperative (Coop); or,
 3. sold in the spot market to wine-making firms (IOF).
- **Cooperatives** process the grapes of their members, but
 - may also buy grapes from non-members (usually $\leq 50\%$).They can then sell the wine (bottled or bulk) to wine-merchants or retailers.
- **Wine-merchants**, on the other hand, can
 - buy grapes (and make wine) or bulk wine which they bottle and sell to retailing outlets.

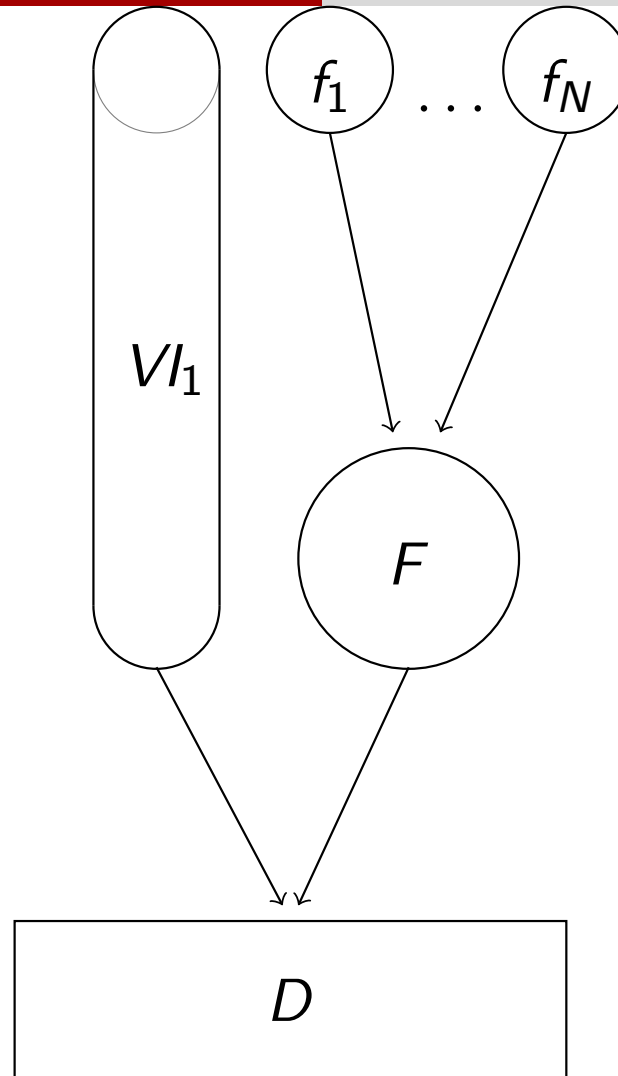


Figure: Simplified market organization

Table: Names of firms producing wines in different countries

Firms	France	Italy	Spain
<u>Grapes production</u>			
Vine-grower (Farm)	Viticulteur (Producteur)	Viticoltore (Produttore)	Viticultore
<u>Wine production</u>			
Winery (VI)	Vigneron	Vinificatore	Bodega (Cosechero)
Cooperative (Coop)	Cave coopérative	Cantina sociale	Bodega cooperativa
Wine-merchant (IOF)	Négociant (N. vinificateur)	Vinificatore industriale	Bodega elaboradora

Questions I

In this **ongoing project** we investigate the following questions.

- ① First of all, WHICH firms decide to vertically integrate, i.e., to make wine 'in-house'?
- ② If a farm decides NOT to make wine in its own premises,
 - should it JOIN a cooperative to invest collectively and forward vertically-integrate to make wine together with other farms? Or,
 - would it be better to SELL its grapes to other wine-making firms, in the spot market or through (short- or long-term) contracts?
- ③ What are the benefits and costs of each option, and what explains individual farms' choices?
- ④ Last, are these choices affected when QUALITY is an important dimension in wine production?

Contribution I

- Extending recent contributions in trade theory, we develop a model with the following main ingredients:
 - First of all, to make or sell wine (or to process/market any raw commodity), a firm needs to make a fixed investment, equal for every firm.
 - Firms are heterogeneous, and so only more productive (or bigger) firms can reach the scale needed to have positive returns from the fixed investment.
 - The firms that do not find it profitable to make wine in-house can then have their grapes processed elsewhere.
 - This can happen by selling them to specialized ‘private’ wine-makers (IOFs), or by delivering them to a wine-making cooperative.
- We are thus developing a **theoretical model** to explain the overall industrial organization of the wine sector.
- Moreover, we are collecting **data** to empirically test the model’s main predictions.

Contribution II

- Work still in progress, but **preliminary results** show that:
 - more efficient farms are able to vertically integrate, while less efficient ones do sell grapes downstream.
 - If the downstream firm is a cooperative, it will offer a higher price compared to an IOF, so that there will be more aggregate production,
 - in other words, there will be more entry (or less exit) into the farming sector.
 - However, the effect on the *VI* firms is the opposite, since fewer firms will decide to invest on wine-making.
- Notice that (caveats):
 - We only have one firm downstream, so that we do not consider the possible competition among different firms downstream.
 - In addition, we do not consider yet that wine-merchants can also backward-vertically integrate by entering into grapes growing.

Literature, I

- Contractual view of VI (Williamson)
 - Hazards of idiosyncratic exchanges:
 - competitive markets → agreements → bilateral monopoly,
 - → hold-up.
- Incomplete contracting view of VI (Grossman-Hart-Moore)
 - Contracts are incomplete,
 - → ownership assigns residual rights of control,
 - → modifying incentives to invest and efficiency.
- Other explanations for VI in agriculture
 - Transaction costs in LDCs;
 - direct selling, e.g., Agbo et al., JEBO, 2015;
 - resource-based and TC (Traversac et al., FP, 2011).
- Trade literature (Melitz)
 - firms are heterogeneous in their efficiency,
 - they face the same fixed costs of exporting,
 - → only efficient firms export.

The model, I

BASIC STRUCTURE

The major assumptions of the model are the following.

- An exogenous set of heterogeneous producers (or farms).
- Each producer is growing grapes with a general technology represented by a cost function with both variable and fixed costs.
- There is a fixed cost of entry and a production cost for each stage of production.
- Producers are heterogenous in the variable cost component. The variable cost of producing grapes is $\theta \frac{x^2}{2}$, where
 - θ is an idiosyncratic productivity shock, and
 - x the quantity of grapes.
- One unit of grapes \Rightarrow one unit of wine, at cost c .

The model, II

DEMAND SIDE

- Demand for wine: a representative consumer (with taste for variety) has quadratic utility

$$u = x_0 + \alpha Q^c - \frac{b}{2} \left(\sigma \int_{\Omega} q^c(\omega)^2 d\omega + (1 - \sigma) Q^{c2} \right)$$

where ω indexes each variety of wine and the outside good x_0 is taken as the numeraire.

- Consumer has revenue Y , so that the budget constraint is $Y = x_0 + \int p(\omega) q^c(\omega) d\omega$. With L consumers, the demand for ω is

$$p(\omega) = a - \tilde{b}(\sigma x(\omega) + (1 - \sigma)X)$$

where $\tilde{b} = b/L$, $x(\omega) = Lq^c(\omega)$ is the individual production, and $X = LQ^c = L \int_{\Omega} q^c(\omega) d\omega$ is the aggregate production of wine.

The model, III

- Each firm is identical ex-ante and receives a noisy signal ν of their productivity θ and the law of θ conditionally on ν is $G(\theta/\nu)$ (draw iid for each firm with law $F(\nu)$).
- Based on this signal, each firm has to decide whether to enter by
 - producing grapes and wines (Vertical Integration), or
 - only grapes (Non-Vertical Integration),
 by paying entry costs, respectively E_{VI} and E_{NVI} .
- Once it has entered, it discovers its productivity θ and has then to decide either to stay or to exit the market (if productivity is too low to be profitable).
- As in Melitz (2003), there is endogenous entry, but:
 - firms are heterogeneous ex-ante, and decide entry based on ν ;
 - they realize their productivity θ only after entry occurs;
 - → possible overlap between distributions of productivity for VI and NVI ;
 - overlap → no perfect sorting, as in Ulyssea (2018).

The model, IV

- If the firm does NOT vertically integrate it faces a downstream firm – called F – that will buy at price w the grapes to produce wine with unit cost c^F and fixed cost K .

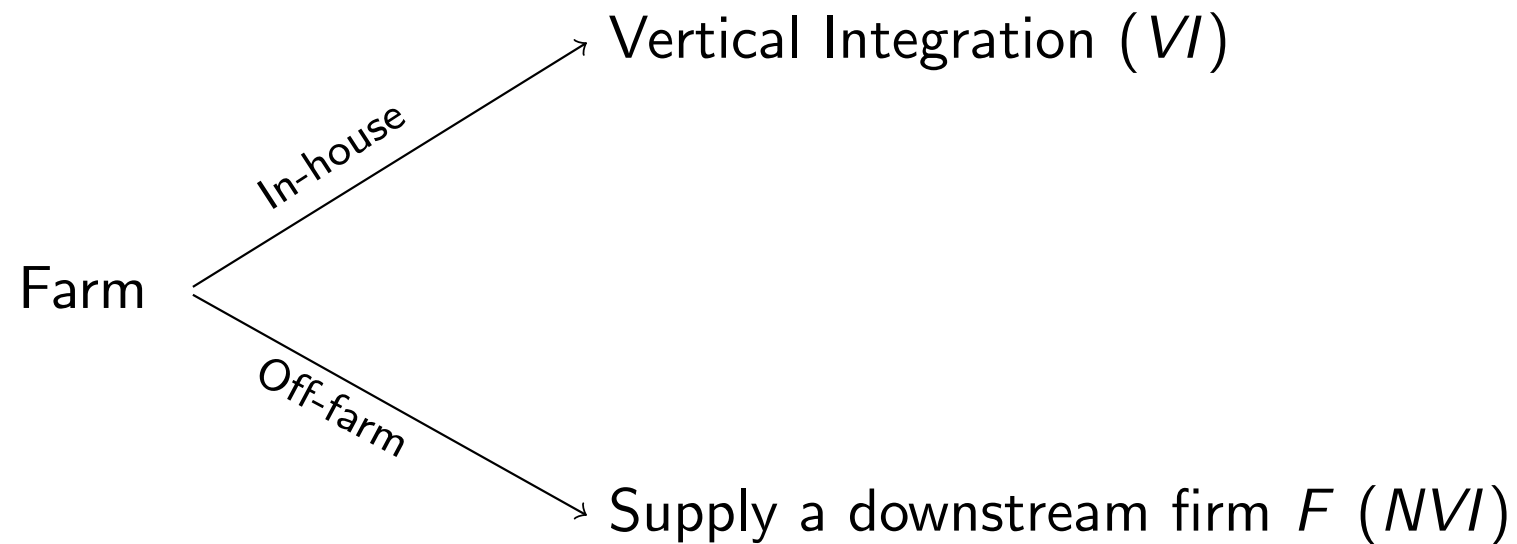


Figure: The decisions at the farm's level

The model, V

- The downstream firm can be either
 - an **Investor Owned Firm** (IOF), which maximizes its own profit when choosing w , or
 - a **Cooperative** (Coop), which will choose w to maximize members' profits under a budget constraint.
- The firm F will produce a quantity X^F and a VI firm with index ω will produce a quantity $x(\omega)$.
- Hence aggregate production on the market is

$$X = X^F + \int_{\text{set of VI firms}} x(\omega) d\omega,$$

$$X = X^F + X^{VI},$$

that is, the sum of production by firm F (either an IOF or a Coop) and the aggregate production of VI firms denoted X^{VI} .

The VI firm, I

- The profit expression is

$$\max_p \pi = p(x)x - \theta \frac{x^2}{2} - cx - f_{VI},$$

which FOC is

$$(p' - \theta)x + p - c = 0,$$

that gives

$$x(\theta) = \frac{\alpha}{2\tilde{b}\sigma + \theta},$$

where $\alpha = a - c - \tilde{b}(1 - \sigma)X$.

- Notice that production is decreasing in θ , the productivity.

The VI firm, II

- We can check that π is decreasing in θ (envelope theorem), so that there exists a **threshold of types** $\hat{\theta}$ indifferent between producing and exiting the market:

$$\pi_{VI}(\hat{\theta}) = 0.$$

- Notice that $\hat{\theta}$ is a decreasing function of X (through α):
 - if market aggregate production increases, this generates a **selection effect** in favor of the more efficient VI firms that stay on the market.
- Note that the aggregate quantity X^{VI} depends on the aggregate X^F :
 - directly (negatively), because if firm F increases its production (by offering a larger w to farmers) it would directly depress the production of VI firms (substitution effect in final demand), and
 - indirectly, through changes in $\hat{\theta}$.
(Recall that $\hat{\theta}$ is decreasing in $X = X^F + X^{VI}$.)
- We thus have the following.

The VI firm, III

Proposition 1. *The selection effect - the extensive margin - reinforces the fact that X^{VI} decreases each time X^F increases.*

Therefore, the selection effect magnifies the (intuitive) direct negative relationship between X^F and the aggregate quantity X^{VI} of VI firms (because $\hat{\theta}$ is endogenous).

What about the total effect on X ?

Proposition 2. *An increase in X^F leads to an increase in X . Consequently, for the VI sector there is more competition, and thus lower size and profit per firm, i.e., a lower $\hat{\theta}$.*

The VI firm, IV

- Suppose that X^F increases for whatever reasons (e.g., a move from an IOF to a Coop, for instance).
 - Despite having X^{VI} decreasing, nevertheless X increases.
 - Individual x_{VI} decreases (i.e., smaller size for VI firms), so does their profit π_{VI} ;
 - in the end, this makes VI less interesting (both $\hat{\theta}$ and π_{VI} decrease).
- In brief, the change from an IOF to a Coop does NOT benefit VI firms, thus inducing less entry into vertical integration.
- We thus get a result similar to that established by Fulton & Giannakas (2013):
 - in a different setting, they show that the presence of a Coop raises the price w , which however may NOT benefit all upstream farmers.
- In our setting, the price increase does NOT benefit the VI farmers.

The grapegrower, I

- The market price for grapes is w and thus the grower chooses how much to produce:

$$\max_x wx - \theta \frac{x^2}{2} - f_{NVI},$$

and the FOC gives

$$x = \frac{w}{\theta}.$$

- The profit obtained is thus

$$\pi_{NVI}(\theta) = \frac{w^2}{2\theta} - f_{NVI},$$

which is decreasing in θ , increasing and convex in w .

- Moreover, the threshold type $\tilde{\theta}$ is such that

$$\pi_{NVI}(\tilde{\theta}) = 0 \Rightarrow \tilde{\theta} = \frac{w^2}{2f_{NVI}}.$$

Entry, I

- For a firm with signal ν , the expected profit of entry under VI is

$$V_{VI}(\nu) = \int_0^{\hat{\theta}} \pi_{VI}(\theta) dG(\theta/\nu),$$

while under NVI it is:

$$V_{NVI}(\nu) = \int_0^{\tilde{\theta}} \pi_{NVI}(\theta) dG(\theta/\nu).$$

- Entry in VI occurs if

$$V_{VI}(\nu) - E_{VI} \geq \max(V_{NVI}(\nu) - E_{NVI}, 0),$$

while entry in NVI occurs if

$$V_{NVI}(\nu) - E_{NVI} \geq \max(V_{VI}(\nu) - E_{VI}, 0).$$

Entry, II

- Assuming that $E_{VI} > E_{NVI}$, that is, that the entry cost is larger under VI, if entry occurs in both situations then there exist two thresholds, ν_1 and ν_2 , such that $\nu_1 < \nu_2$ and

$$V_{NVI}(\nu_2) = E_{NVI}, \quad (1)$$

$$V_{VI}(\nu_1) = V_{NVI}(\nu_1) + E_{VI} - E_{NVI}. \quad (2)$$

- Therefore,
 - all firms with a sufficiently good signal, i.e., $\nu \leq \nu_1$, enter into VI,
 - while others with not too high signals ($\nu_1 \leq \nu \leq \nu_2$) enter into NVI.



F is an IOF, I

- The IOF would like to buy grapes at price w from a set $\Phi = [\underline{\theta}, \tilde{\theta}(w)]$ of grapegrowers. The quantity to be traded is

$$X^F(w) = \int_{\Phi} \frac{w}{\theta} dG_{NVI}(\theta).$$

And the profit is:

$$\begin{aligned} \max_w \pi^F &= p(X^F)X^F - (w + c^F)X^F - K \\ &\text{s.t.} \\ p(X^F) &= a - \tilde{b}(\sigma X^F + (1 - \sigma)X). \end{aligned}$$

F is an IOF, II

- The FOC for the atomistic firm is

$$\left[p'(X^F)X^F + p(X^F) - w - c^F \right] X^{F'}(w) = X^F,$$

or equivalently

$$MR = MC + \frac{X^F}{X^{F'}(w)},$$

where $MR = p'(X^F)X^F + p(X^F)$ is the marginal revenue, and $MC = w + c^F$.

- Standard FOC for a monopsony, with a double incentive to reduce production:
 - to extract surplus from consumers (downstream), and
 - surplus from suppliers/farmers (upstream).

Having computed w , X^F and X^{VI} we then go back to the thresholds ν_1 and ν_2 that can be found by solving Eqs. (1) and (2).

F is an IOF, III

Remark 1 Notice that $X^{F'}(w)$ has two components:

- i) the intensive margin, a direct positive effect because an increasing procurement price w will induce existing upstream firms to produce more; and
- ii) the extensive margin, an 'indirect' positive effect because a higher procurement price will induce more (inefficient) farmers to stay in business ($\tilde{\theta}(w)$ is increasing in w) instead of exiting.

When the firm F is a COOP, I

- The Coop would choose the grape price w to maximize members' profit subject to the budget constraint:

$$\begin{aligned} & \max_w \int_{\Phi} [\pi_{NVI}(\theta)] dG_{NVI}(\theta), \\ & \text{s.t.} \\ p(X^F)X^F &= (w + c^F) X^F + K, \\ X^F(w) &= \int_{\Phi} \frac{w}{\theta} dG_{NVI}(\theta). \end{aligned}$$

When the firm F is a COOP, II

- As the profit $\pi_{NVI}(\theta)$ and $X^F(w)$ are both increasing in w , the solution is straightforward.
 - The Coop chooses the largest w compatible with the budget constraint.
 - Assume that $p(X^F)X^F - (w + c^F)X^F$ is concave then it can have two intersection points at most with K and the Coop will choose the largest one in order to maximise X^F and thus profits for members.
 - By contrast, the IOF choose the price that maximizes $p(X^F)X^F - (w + c^F)X^F$ which is necessarily on the left to the w chosen by the Coop.
- \Rightarrow we thus get the result that the IOF underproduces compared to the Coop.

Preliminary results, I

The main results (proofs to be completed) are the following.

1. The **Coop over-produces** with respect to the IOF, that is,

$$X_{Coop}^F > X_{IOF}^F,$$

- In effect, for the IOF – as a monopsonist – it is impossible to extract all the farmers' surplus with a unique price w ; it thus distorts downwards the price offered to supplier in order to maximize its profit.
- The Coop however does NOT suffer from this problem as it does not try to extract surplus from the farmers; instead, it offers a surplus maximizing price to the farmers (w_{Coop}) which is larger than that offered by the IOF, i.e., $w_{Coop} > w_{IOF}$.

Preliminary results, II

2. Hence there are **more active firms with a Coop** than with an IOF, and so the thresholds are such that $\tilde{\theta}_{Coop} > \tilde{\theta}_{IOF}$.
- This in turn generates more entry for grapegrower when you have a Coop (ν_2 is larger for a Coop).
 - Which implies that there is less entry into VI probably, i.e., ν_1 is probably lower.
 - Does this mean that there is less product diversity for the consumers?
 - Could we have some negative impact on welfare with a Coop in such a case?
 - To be investigated...

Quality

Table: Distribution of wine production (in 000 HI) across quality and firms (Italy, 2012)

Wine	VI		IOF		Coop		Total	
Table	2,907	(17%)	6,421	(38%)	7,587	(45%)	16,916	(100%)
	(24%)		(62%)		(34%)		(38%)	
PGI	3,709	(29%)	1,683	(13%)	7,377	(58%)	12,770	(100%)
	(30%)		(16%)		(33%)		(28%)	
PDO	5,746	(38%)	2,210	(14%)	7,332	(48%)	15,2894	(100%)
	(46%)		(21%)		(33%)		(34%)	
Total	12,364	(27%)	10,315	(23%)	22,297	(50%)	44,977	(100%)
	(100%)		(100%)		(100%)		(100%)	

Adapted from Mazzarino & Corsi, 2015.

Quality, I

1. **Quality** in wine markets has an important role.

- When quantity-efficient heterogeneous producers, only more productive firms can vertically integrate, i.e., pay the fixed-cost investments.
- What if quality-efficient producers?
 - Can a relatively (small but) high quality firm be able to VI into wine-making?
 - Which producers would be attracted into the Coop?
 - Which would sell their grapes into the spot market?
- What is the relevant metrics to use when comparing the performance of IOF and Coop firms?
 - Which is the relevant 'IOF'? The VI farm or the wine-merchant?
 - Pennerstopf & Weiss (2012), for instance, consider a mixed-oligopoly and compare an IOF to a Coop. Theirs is, in fact, a VI firm.

Quality, II

2. Model

- Now farms are heterogeneous in exogenous quality potential.
- Each farm produces one unit of production, with cost δs , where s is the idiosyncratic quality shock.
- Farmers are ex-ante identical, but receives a noisy signal ν , based on which and after paying the entry costs E_{VI} and E_{NVI} , decide whether to enter into VI or not (NVI).
- Representative consumer has quadratic utility, with taste for variety, and revenue Y . The WTP for one unit of quality $s(\omega)$ is

$$p(\omega) = \alpha + \beta s(\omega) - \gamma N.$$

- Downstream, the firm F produces a quantity N^F with average quality

$$S^F = \frac{1}{N^F} \int_{\Omega^F} s(\omega) d\omega.$$

Quality, III

3. The VI firm's problem

- The profit expression is the following:

$$\pi^{VI}(s) = p(s) - \delta s - c - f_{VI}.$$

- If we define the cut-off type \hat{s} such that $\pi^{VI}(\hat{s}) = 0$, we can rewrite the profit for a quality- s firm as

$$\pi^{VI}(s) = (\beta - \delta)(s - \hat{s}).$$

- There are two possible cases.

$\beta > \delta$ Quality-friendly environment. The profit $\pi^{VI}(s)$ is increasing in s , and only firms with $s > \hat{s}$ are active in equilibrium: $N_{VI} = \int_{\hat{s}}^{s_M} dG_{VI}(s)$.

$\beta < \delta$ Quality-hostile environment. The profit $\pi^{VI}(s)$ is decreasing in s , and only firms with $s < \hat{s}$ are active in equilibrium (because of lower costs): $N_{VI} = \int_0^{\hat{s}} dG_{VI}(s)$.

Quality, IV

4. The NVI firm's problem

- The profit is the following:

$$\pi^{NVI}(s) = w - \delta s - c - f_{NVI}.$$

- The equilibrium now depends on the pricing scheme chosen by the firm F .

$w = w_0$ If constant price, F will attract only low quality farms.

$w = w_0 + w_1 s$ If bonus for quality, the F will attract

- high-quality farms if $w_1 > \delta$, and
 - low-quality farms if $w_1 < \delta$.
 - Also, entry is costly \rightarrow they need to be ensured ex-post positive profits.
 - Timing issue: commitment by the F ? Long-term contracts?
- If we assume that bonus for quality is endogenously determined in equilibrium, we have the following profit (\tilde{s} is the threshold):

$$\pi^{NVI}(s) = (w_1 - \delta)(s - \tilde{s}).$$

Quality, V

5. (Very) Preliminary results

- Still many issues to be solved, but so far we have obtained similar results to the case of quantity-efficiency.
- Indeed, given that the Coop offers higher prices for grapes, the IOF underproduces compared to the Coop.
- To be continued ...
- Regarding quality, one aspect is of interest:
 - is quality influencing organizational form, or
 - is the organizational form influencing quality?
 - Some (e.g., Giraud for Burgundy) argues for the latter.
 - We model the first.
 - It may be good to test which one theory is confirmed by the data.

Caveats

1. A more realistic Coop

- Our Coop maximizes members' profits.
- However, to have a more realistic model we need to introduce some disadvantages for the Coop as well.
- One could argue, for instance, that the coop is less efficient, that is the marginal cost of producing wine c^F is larger for the Coop than for the IOF because of:
 - internal lack of cost minimization,
 - horizon and free-riding problems,
 - costs of collective decision-making,
 - management capture, etc.

Caveats

2. Competition

- Downstream we have only ONE firm F .
- It should be possible to introduce MORE winemaking firms like F of different nature (IOF or Coop)
→ need to have a simple model on how heterogeneous farmers NVI will select one or the other firm(s) F .
- We want to compare these different firms, looking at whether and how they differ in arranging their procurement from NVI upstream farms.
- There are different options. See Figures (3), (4), and (5), representing different competitive situations and possible modeling choices.

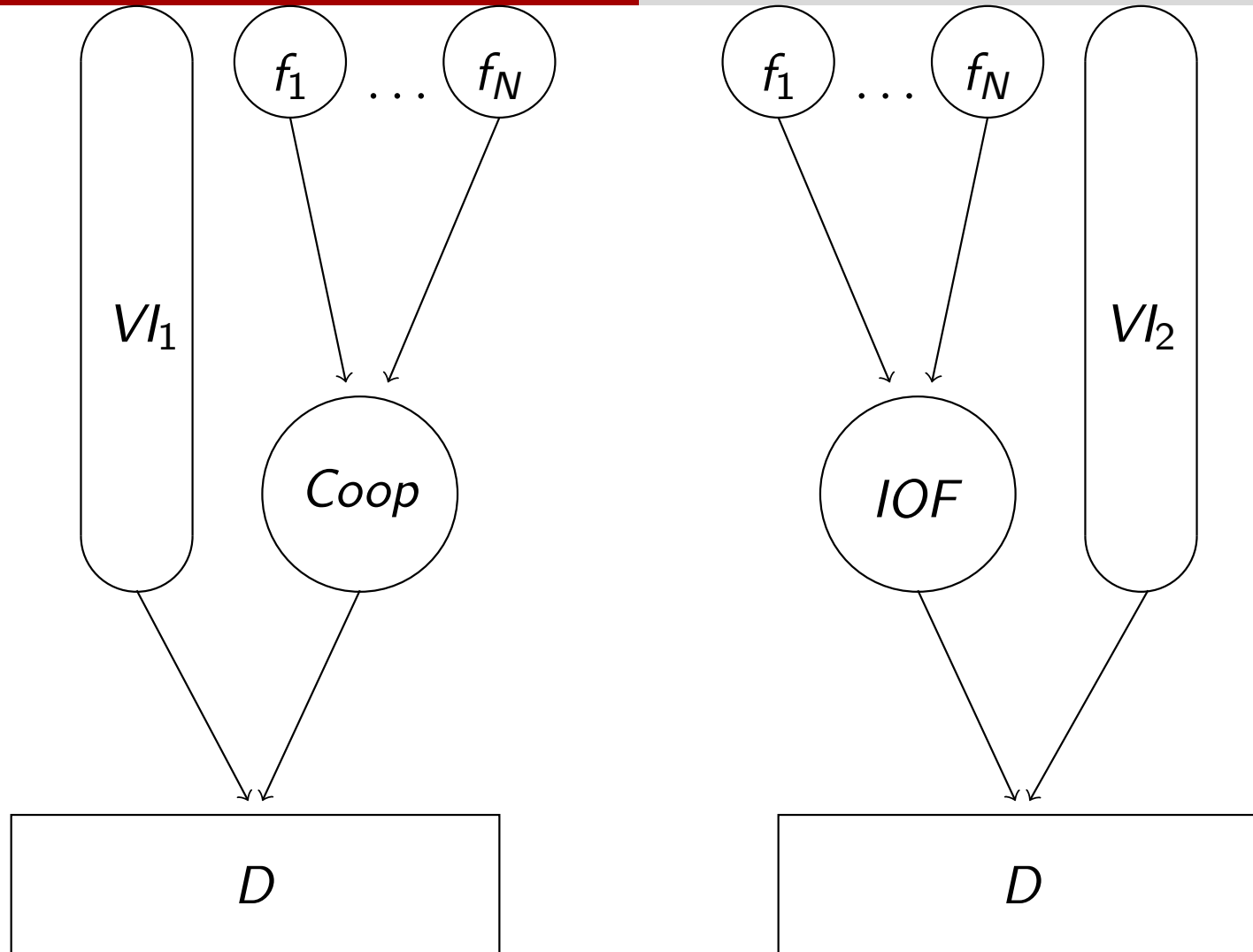


Figure: Vertical integration with F in 'isolation' (L or R)

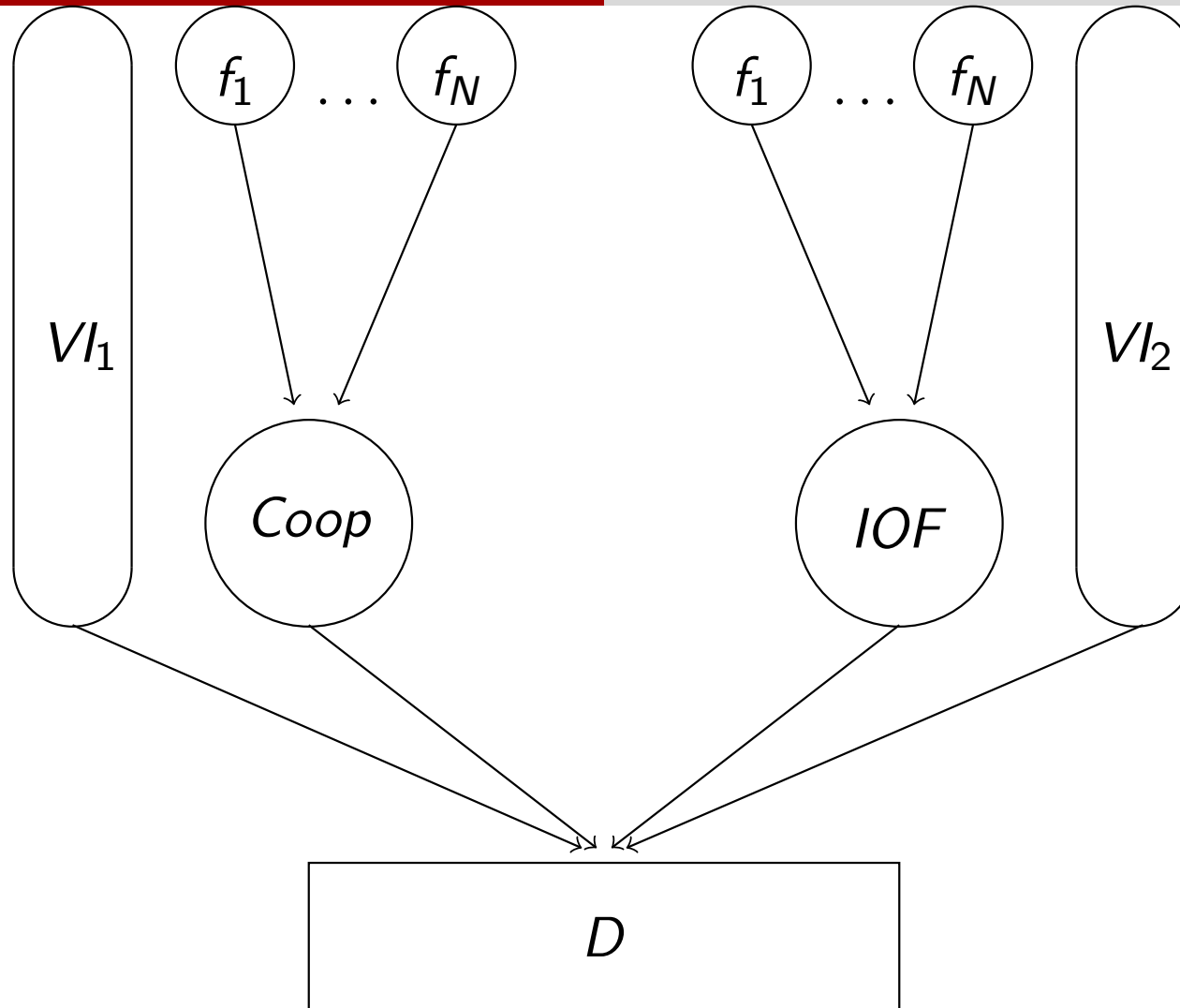


Figure: Vertical integration with Downstream competition

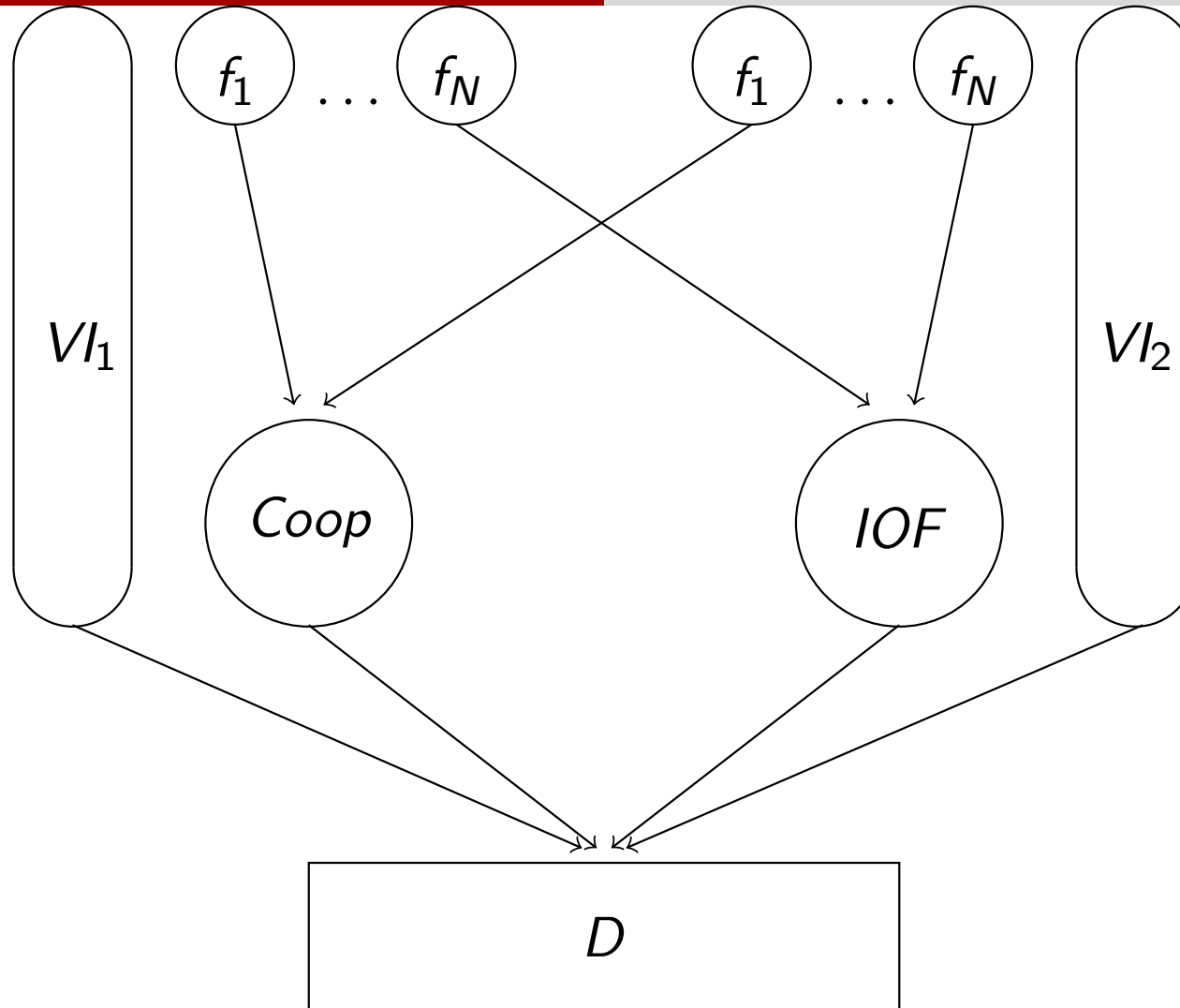


Figure: Vertical integration with Upstream & Downstream competition

Concluding remarks

- These are preliminary results of an ongoing project.
- We need to complete the theoretical investigation, but also to test our model predictions with the data.
- In particular, we would like to explore and test the predictions about the impact of fixed costs, heterogeneity, market competition, etc.
- In terms of further theoretical modeling, we would like to extend the model to consider different aspects. For instance,
 - the impact of quality,
 - the increase of market size (globalization) and competition,
 - what happens when downstream market, e.g., retailing sector, requires further investments, such as advertising, distribution investments, etc.;
 - what is the role and impact of regulations, for instance PDO regulations.